Running RHIC Like a Swiss Watch

or: Surpassing 60% Time at Store

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Overview

- Time at store: review
- General solutions
- Operational efficiency issues
- Summary

Time at Store: review

- Every 5 min saved/ramp = 1 day store time over entire run = 1% more time in store over Run-6 (W.Fischer)
- What is "60% at store"?
  - Lumi-on to lumi-off/calendar time
    - No discounts for APEx, Scheduled Maintenance
    - Excludes beginning and end of store activities
      - Short of quicker turn-on (experimenter modifications/shielding) and auto-collimation, few remaining advances
      - Refine polarization measurement sequence? 1-2%
- Achieved 53% Run-4, 52% Run-5, 43% Run-6

General Solutions

- Cycle-cycle issues
  - Reduce ramp time
    - Au: already minimized?
    - p↑: rotators +8-10 min up, +11-16 down 4-5%
      - Ramping speed already maximized?
      - Run DC or incorporate in energy ramp?
  - Reduce store waste
    - Not discussed here
  - Reduce injection time
    - Discussion follows
- Run-long issues
  - Reduce system failures, failed ramps
    - See other presentations
  - Reduce recovery time
    - From apex, maintenance, failure

Reducing Cycle Time – Injection

- It's always something…
  - Store-store 100 GeV run, preliminary data: 135/342 ramps, 9.35 hr avg
    - 12 hr cut: 112/135 physics stores, 4.3 hr avg
    - Back-back: 58/112 stores, max 6, 2.75 hr avg
      - Fastest: 1.12 hr
      - 6/7 APEx had back-back stores following
    - Without failure: 12/last 27 back-back stores, 1.39 hr avg
      - 5 experiment access, 5 injector failure, 5 RHIC failure
  - ~50 min fixed store-store time this run.
- p↑ fill time: at least 15 min.
  - Multibunch injection or faster rep period saves up to 10 min. 2%

Reducing Cycle Time – Injection (cont'd)

- p↑ injection is over-constrained
  - Intensity, polarization, transverse & longitudinal emittance
  - Having reproducible injectors mitigates impact
  - Pressure from AGS development hinders injector readiness
- Heavy ions: source readiness dominates
- Cost-benefit of injection tuning?
  - Saves failed ramps, undesirable store conditions
  - Time spent at injection can be excessive
    - Establish better injection conditions at start of run, allow for time to retune during Machine Development
    - Auto AtR correction, more automation of diagnostics

Maximizing Run Time - Recovery

- Reduce failures requiring access
  - LO/TO has become (even more) time consuming
  - Make simple resets remote or remove equipment from primary areas
    - Node cards, polarimetry, etc.
    - Plugged jet target (not so simple), cryo processors
  - Remote inspection apparatus?
- Enhance pre-beam diagnostics of systems
  - Cascading or end-of-chain failures delay overall recovery time.
- Can we speed up the recovery that follows repairs?

Operational efficiency issues

- Operations' tools
  - Ramp Editor, polarControl, Artus improved
  - PASS, Rhic Injection, collimation, Sequencer still problematic
  - Continue effort to automate
    - Operator-intensive measurements, tuning slow down the process
    - Reduce manual dumps to elogs
    - Maintain control system standards, allow for sequencing

Operational efficiency issues (cont'd)

- Communication/coordination
  - Run coordination was at an effective and appropriate level.
  - Communication tools (phone, BERT, elog) have improved but need further improvement and more diligent management.
  - Additional documentation has been beneficial; effort must continue.
    - OpsWiki, RHIC cycle checklist, Start-Up guides
- Understaffing is a factor

Summary

- 60%: you can't get (all the way) there from here.
  - Protons: 7% Ions: 0%
  - Remaining operational efficiency improvements are intangibles which make (many) small contributions to increased time at store.
- Injector chain management paramount, for ions and protons.
- AtR/injection needs more attention at Start-Up and during the run.
- Track more data (and automate?)
  - End of store, store-to-store, injection time